Variance Estimates for Total Estimates

Let

$\hat{Y}_L^t$ = The estimated total for data item Y at tabulation level L, industry by tax status, for time period t computed from the entire sample

$\hat{Y}_{L,g}^t$ = The estimated ***replicate total*** for data item Y at tabulation level L for time period t computed from the g[th] random group of noncertainty sampling units (w_i^t = 1), where g=01, 02, ... 16, and the certainty sampling units (w_i^t = 1)

$\hat{Y}_{L,00}^t$ = The weighted total for data item Y at tabulation level L for time period t computed from the certainty sampling units (where random group=00 and w_i^t = 1); this term can be zero

G = 16

$i \in (L, g)$ denotes units assigned to random group g that possess characteristics of tabulation level L

Then, the g[th] replicate total for data item Y at tabulation level L for time period t is computed as

$$\hat{Y}_{L,g}^t = G\left(\sum_{i \in (L,g)} w_i^t y_i^t\right) + \hat{Y}_{L,00}^t$$

The sum in parentheses of the preceding formula is referred to as the random group total.

Then the estimated variance of $\hat{Y}_L^T$ is computed as

$$v\left(\hat{Y}_L^t\right) = \frac{1}{G(G-1)} \sum_{g=1}^{G} \left(\hat{Y}_{L,g}^t - \hat{Y}_L^t\right)^2$$

Variance Estimates for Ratio Estimates

Let

$\hat{R}_L^t$ = the estimated ratio of interest at tabulation level L for time t computed from the entire sample

$\hat{R}_{L,g}^t$ = the estimated replicate ratio of interest at tabulation level L for time period t computed from the g[th] random group of noncertainty sampling units (w_i^t = 1), where g=01, 02, ... 16, and the certainty sampling units (w_i^t = 1)

$$= \frac{\hat{Y}_{L,g}^t}{\hat{X}_{L,g}^t}$$

where L, g, $\hat{X}_{L,g}^t$, and $\hat{Y}_{L,g}^t$ are defined as in the **variance estimates for total estimates** above.

Then the estimated variance of $\hat{R}_L^t$ is computed as

$$v\left(\hat{R}_L^t\right) = \frac{1}{G(G-1)} \sum_{g=1}^{G} \left(\hat{R}_{L,g}^t - \hat{R}_L^t\right)^2$$

Variance Estimates for Period-to-Period Percent Change Estimates

Let the year-to-year percent change estimate, $\hat{T}_L^t$, be defined as

$$\hat{T}_L^t = \left(\frac{\hat{Y}_L^{t_1} - \hat{Y}_L^{t_2}}{\hat{Y}_L^{t_2}}\right) * 100$$

$$= \left(\hat{R}_L^t - 1\right) * 100$$

Then the estimated variance of this estimate is computed as

$$\begin{aligned} v\left(\hat{T}_L^t\right) &= v\left[\left(\hat{R}_L^t - 1\right) * 100\right] \\ &= (100)^2 v\left(\hat{R}_L^t\right) \\ &= \frac{(100)^2}{G(G-1)} \sum_{g=1}^{G} \left(\hat{R}_{L,g}^t - \hat{R}_L^t\right)^2 \end{aligned}$$

Variance Estimates for Percent Contribution of Component NAICS to Aggregate NAICS Estimates (E-Stats Report)

Let the percent contribution of a component NAICS to aggregate NAICS estimate, $\hat{P}_{L_1/L_2}^t$ be defined as

$$\begin{aligned} \hat{P}_{L_1/L_2}^t &= \frac{\hat{Y}_{L_1}^t}{\hat{Y}_{L_2}^t} \\ &= \hat{R}_{L_1/L_2}^t \end{aligned}$$

where L_1 and L_2 denote the component and aggregate NAICS codes, respectively.

Then the estimated variance of this estimate is computed as

$$\begin{aligned} v\left(\hat{P}_{L_1/L_2}^t\right) &= v\left(\hat{R}_{L_1/L_2}^t * 100\right) \\ &= (100)^2 v\left(\hat{R}_{L_1/L_2}^t\right) \\ &= \frac{(100)^2}{G(G-1)} \sum_{g=1}^{G} \left(\hat{R}_{L_1/L_2,g}^t - \hat{R}_{L_1/L}^t\right)^2 \end{aligned}$$